

THE CANADIAN ISTAR INFORMATION-CENTRIC COLLABORATIVE WORKSPACE CONCEPT

PAPER TWO

The Info-Centric Collaborative Workspace from the Processes Perspective

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Abstract

1. Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) is an evolving information operations (IO) concept in the Canadian Land Force. ISTAR provides the commander with a system to collect and process required information for producing intelligence on the threat and knowledge on the environment during operations, as well as knowledge needed to identify, acquire and engage targets. The various processes used to collect and analyze the information are the result of numerous individual systems some of which have only been recently introduced in the field while many others are still in development as a result of advances in the information age. This compendium of systems makes ISTAR a “System of systems”, as opposed to a single system. These four papers present the new Canadian information centric collaborative workspace concept that provides a more coherent information management approach to better support the Commander in both its tactical intelligence and operations activities at brigade level. The info-centric collaborative workspace concept aims at offering a seamless collaborative environment enabling the ISTAR staff to perform their tasks using different applications / services through a standardized Human Computer Interface (HCI).

Introduction

2. The explosion of information technologies has set in motion a virtual tidal wave of change that is in the process of profoundly affecting both organizations and individuals in different aspects. This means that military organizations also face a tidal wave of transformation of an irresistible force that, at the same time, offers unprecedented challenges. The military does not have much choice. Resisting transformation is futile. However, accepting transformation in only the technological aspect is also not a valid option. Today, improvements in processing power and communications means make information technologies even more attractive and cost-effective for organizations to implement. Willingly or not, we have entered the information age. As Owens puts it, for a long time, information has been inseparable from commanders, command structures, and command systems [Owens 95]. Information is no longer the prerogative of commanders and command structures but has become necessary to all participants in a mission.

3. Many armies have by now learned that when introducing Command and Control (C2) information technologies (IT) to their organization, a series of changes occur in a number of areas and if these changes are not properly taken into consideration in the planning stages of the transformation process, then these changes will become hindrance in the accomplishment of the

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missions thus planting the seeds for the overall rejection of the system. The areas that will be affected and need to be considered in the transition have been regrouped into three main perspectives as illustrated in Figure 1 and are: a) Systems, b) Users, and c) Processes. What is meant by “systems” are the hardware and software components related to Information Technologies (IT) that, when put together according to a set of requirements and specifications, make up IT systems. The term “users” refers to the people and their skills, education, training, experience and Organizations. The term “processes” refers to the Doctrine, Standard Operating Procedures (SOP), and Techniques, Tactics and Procedures (TTP). The successful business solution will be the one achieving best harmony between the three perspectives: Users - Processes - Systems. In this series of papers, the authors will be presenting one by one, each apex of this harmony triangle and the achieved business solution. The first paper covers the Canadian military organization and the transformation needed to exploit the new emerging Command Support environment from an information centric collaborative environment perspective. The second paper presents the ISTAR context and its inherent imbedded processes while introducing the adaptation needed for an organization to become more effective as an information driven organization. The third paper covers the System of systems Service Architecture perspective and describes the approach taken to develop an information centric collaborative workspace solution. The fourth paper brings forward an approach and some techniques to implement the three previous perspectives and keep a global system harmony. It also includes some of the lessons learned in developing and implementing the Canadian Command Support Info-Centric Collaborative Workspace (ICCW) using a value management approach.

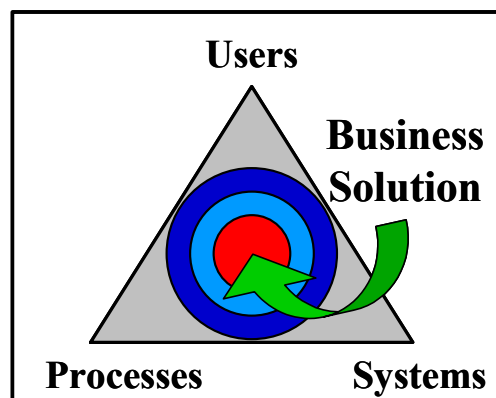


Figure 1: System of Systems Harmony Triangle:
Users - Processes - Systems

The Ingredients for “Processes” Transformation

4. In the Canadian Land Force Information Operations doctrine [B-GL 1999], the definition of ISTAR (Intelligence, Surveillance, Target Acquisition, and Reconnaissance) is: “a system where information being collected through systematic observation and sensing is integrated with that collected from specific missions, and is processed in order to meet the commander's information requirements.” ISTAR integrates sensor capabilities and the intelligence process that provides the direction and processing of sensor data. Therefore, the ISTAR constitutes a “System of systems” that is managing and fusing data to serve the command function through integration of a wide range of sensing capabilities and information functions and processes. Considering this “System of systems” approach, the complexity of introducing automated data fusion tools is strongly related to the nature of the available information, its pattern of dissemination, and the organizational adaptation capacity. The project team undertook to review the different processes

and cycles mentioned in the doctrine manuals and tried to see where and how ISTAR processes would fit.

5. Over the years, the military Command and Control business has developed several vertically specialized functions represented by different processes and cycles. Figure 2 presents a few processes and cycles that are directly relevant to our discussion such as the Decision-Action Cycle, the Operations Planning Process (OPP), the Targeting Process, the Intelligence Preparation of the Battlefield (IPB), and the Intelligence Cycle. When one looks at ISTAR processes and plots them on the Figure 2, one can easily observe that the ISTAR Planning phase is a horizontal cross-section of those cycles/processes directly supporting the mission planning effort, while the ISTAR Execution phase is a horizontal cross-section of those cycles/processes directly supporting the mission execution effort. Since the intelligence cycle is playing a major role in both the ISTAR planning and execution phases, it has been represented within its own box. At the beginning of the ISTAR TD project, it was thought that developing tools supporting the intelligence cycle alone would satisfy the requirements but this was not the case. In fact, when developing information systems to support command and control military functions without possessing at first an overall architectural vision of all involved processes, it is often discovered too late that these systems while correctly supporting their vertical functions do not nicely integrate together into a system of systems. We unfortunately inherit not so well integrated “stove-pipe” systems that become a nightmare to both maintenance and training staff.

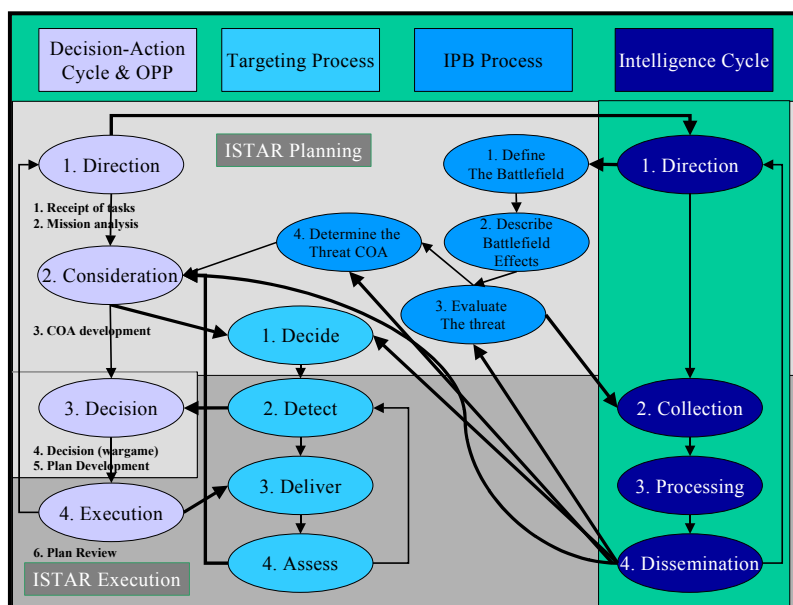


Figure 2: Major ISTAR processes and cycles

6. From the review of doctrinal manuals of the different processes and cycles involved, it is now clear that a new approach should be developed in order to facilitate the integration of the different Command and Control applications in a truly collaborative environment. Indeed, ISTAR has changed the way we do business! Because the overall ISTAR process which belongs to the Force Employment *Sense* function [Dubé 2004] is not independent from its *Command* function, an improved ISTAR business process must then be introduced to facilitate the processing of information and to manage the tasking and re-tasking of ISTAR system components. This justifies the System-Users-Processes approach we have adopted in order to render the ISTAR “System of systems” more efficient as a whole. No perspectives can be left

aside in the design and construction phases and the aim of this second paper is to look at the changes brought to the Commander Battle process with the introduction of ISTAR processes and of the new Canadian Land Force Employment concept.

The Collaborative Environment

7. In a truly collaborative environment there should be, in our judgment, one “Commander’s Battle Process” from end to end. Rather than a process for planning separated from that for execution, reconnaissance, etc., we would see a continuous and fluid progression from initiation and mission analysis, to CCIR development, to synchronization, successful accomplishment of the mission and feedback. Our model for an information centric collaborative workspace would see all commanders working collaboratively on the vertical and horizontal planes in a concurrent, contiguous end-to-end battle process. The technology in the digitized environment will support this; however current organizations and processes need to evolve into a new concept of operations. We have seen in the Paper One of this series that this concept of operations sees the formation of collaborative working headquarters designed around the five operational functions: *Command, Sense, Act, Shield* and *Sustain*. It sees the establishment of five main cells: Command, Current, Sense, Effects and Plans, with the two support cells: Communications and Computer Information Systems (CCIS) and Administrative Support as represented in Figure 3. Functions are represented as required by having staff in the Current, Sense, Effects and Plans cells employed as multi-function general staff but functional cells by themselves have no place in this new organization.

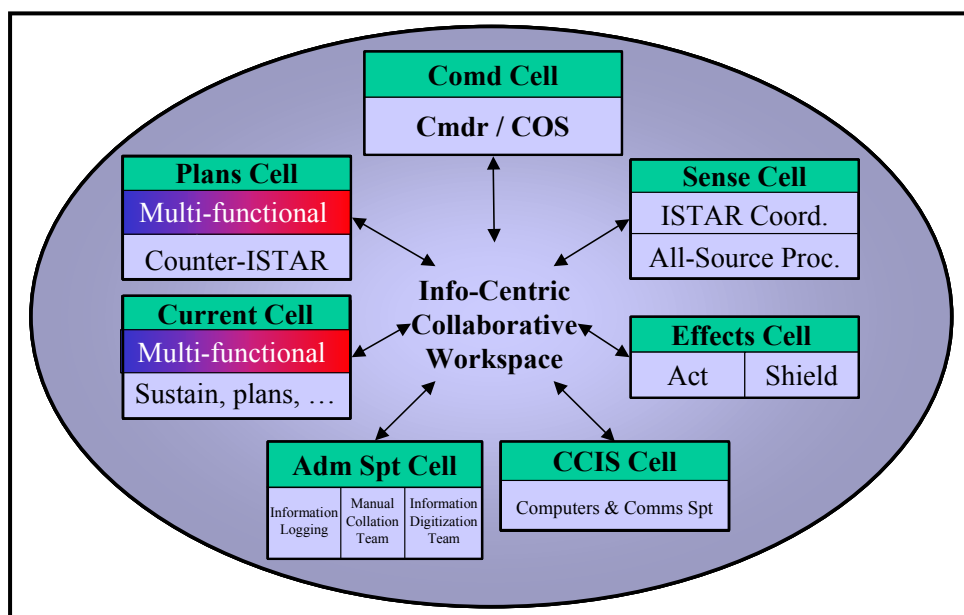


Figure 3: The Info-Centric Collaborative Workspace concept with the new functional cells

8. The new info-centric collaborative environment is modifying the current work organization as to improve our ability to bring all of our information and all of our knowledge and experience to bear. What has changed from the traditional environment of command is the dynamic nature of today’s operations and the need for collaboration in multiple, and ever-increasing, arenas. In today’s and tomorrow’s environment a fluid set of interdependencies, of varying levels of complexity exist inside and outside any particular organization. The commander will be assailed with a flood of information and conflicting stimuli. Additionally, the

speed and tempo with which new information will be generated necessitates that it be analyzed and acted upon faster than any one human can respond. From an information system designer's perspective, the objective is to build a system that maximizes the efficiency and value of the actions "to access, collect and assess information" so that decision-makers get the information and knowledge they need. The assumption being made is that all the functions comprising the new Commander's Battle Process are all working collaboratively on the same network in a manner as to offer a seamless collaborative environment enabling the different workers and analysts to perform their tasks and drilling from the Global Information Environment (GIE) using different applications through a standardized Human Computer Interface (HCI). The underlying concept also assumes that all application components will plug into the workspace environment in a similar fashion irrespective of the military functions being integrated.

The Collaborative Commander's Battle Process

9. It is our contention that the plethora of staff planning processes alluded to earlier must be merged into a single, synchronous and focused commander's battle process. Acknowledging that the battlefield of tomorrow is too complex for the commander to do it all and that supportive and structured staff action is necessary, a collaborative battle process must be developed, wherein collaboration between the commander and the staff and among the staff is an ongoing and continuous process in the planning and execution of operations. In this new process, the commander's battle process is the foundation, and the staff action starts with a demand by the commander for a product or an input and ends with the delivery of this product or input. Furthermore, the boundary between the general staff products or inputs and the specialized functions must be better defined. A simplified process will allow commanders and staff to focus on results rather than on processes.

10. An important study was undertaken by the ISTAR TD project staff to help define a new concept of operations supporting the new precepts of collaborative working. The aim is to define the concept of operations and the operational requirements for a collaborative working environment and to describe its impact on the command support doctrine and the current Land Force Command and Control Information System (LFC2IS) architecture. After reviewing a number of military and civilian sources, the team coined the following definition. One will note that it includes implicitly or explicitly the notions of shared understanding, taking advantage of the diversity of knowledge, experience and intellect of a group, acting toward a common goal and dispersion in time/space. The Command-Centric collaborative working concept in a military operational environment may be defined as [Beno 2004]:

"The process by which a commander makes use of the knowledge, experience and intellect of command and staff teams to achieve a common purpose."

11. In a truly info-centric collaborative environment, there would be, in our judgment, one single "Commander's Battle Process" from end to end which would be enacted by all commanders working collaboratively on the vertical and horizontal planes in a concurrent, contiguous, end-to-end battle process. Each commander would have the choice to work alone or in collaboration with his general staff as the complexity of the situation or the level of command demand. The general staff would serve the commander's process and deliver specific information products as the commander requires. Since the commanders would work collaboratively, they would be in a better position to ensure the congruent orientation of their staff and the staff ability to work collaboratively between HQ.

12. In this new Collaborative Commander's Battle Process, the Commander is not only in the loop, but in fact sits firmly in the saddle, where he sets the tone and focus, and he makes the key

decisions based on real time Situation Understanding (SU). Figure 4 below depicts our concept of where the Commander fits in this Info-Centric Collaborative environment. The general staff no longer serves a separate process, but the Commander's and delivers requested information products to the Commander. The general staff would continue to have the responsibility for interfacing the commander's process with the various functional processes. The end-result would be a continuous and fluid progression from initiation and mission analysis, to Courses Of Action (COA) and plan development, synchronization, successful accomplishment of the mission and after-action review. In our model the staff and functional stovepipes are broken down and information is shared. The Commander or COS would merely have to turn to the head of one of the operational cells (Current, Sense, Effects and Planning) for the appropriate input and they would provide consolidated responses – not simply functional responses. Multi-disciplined staff within each of the operational function cells (Current, Sense, Shield and Planning) would be able to provide multi-disciplined responses. It is to be noted that a new key person in each of the cells is the cell Knowledge Manager. Not only are these individuals responsible for the monitoring and follow up on all incoming information, they are also responsible for the quality of the information that is distributed from the cell. In the Command Cell, there exists a Chief Knowledge Manager whose role is to ensure that the issued Commander's intent and guidance are understood by all in their operational cell context and, in return, that the published information and products from these cells are turned into knowledge for the commander presented in his operational context.

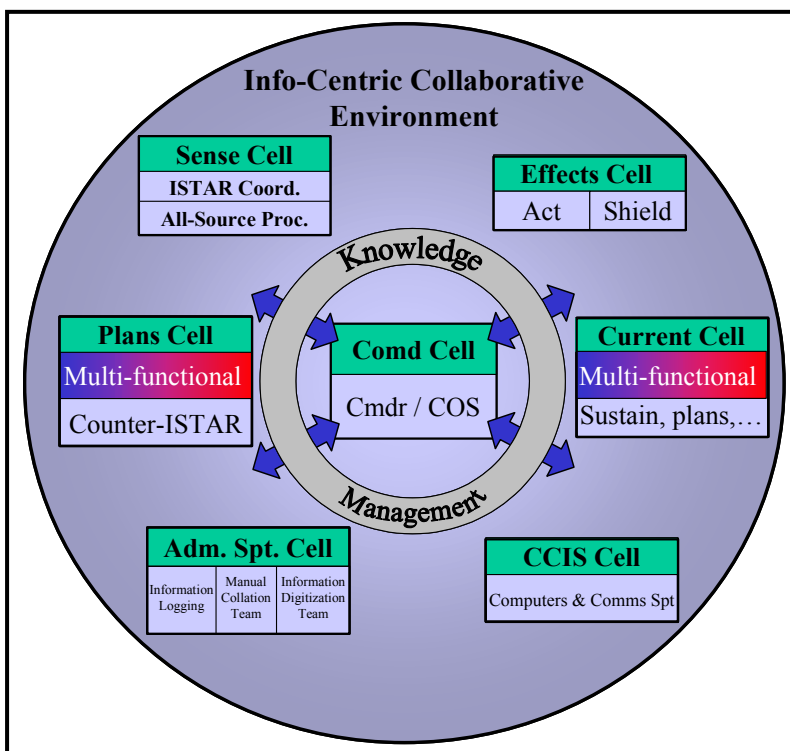


Figure 4: The Commander in the Information-Centric Collaborative Environment

13. We believe that a true collaborative environment will enhance the command function and a commander's ability to command. In a command-centric, knowledge-based environment commanders will trust their staff and want to receive, assimilate and understand the informed opinions and judgments of those who possess the superior expertise in any particular sphere. However, it is the commander's responsibility to create an atmosphere in which subordinates and

staff feel comfortable and unthreatened, even responsible, to offer their best judgment even if it means offering an alternative and minority opinion.

14. The ISTAR TD team set out to improve on current battle processes, and approached this issue with six objectives in mind:

- Identify the end-to-end sequence of key major activities conducted by the commander during his battle management process;
- Identify the key activities that must be done in a collaborative manner (between commanders);
- Simplify the battle process by integrating the desired staff activities;
- Speed up the battle process by ensuring maximum collaboration between commanders at the earliest possible time;
- Identify the contents of key information products; and
- Identify the key process interconnections.

15. The Collaborative working Study yielded to a detailed general staff view and a general to functional staff interface view. However, the study team is confident that the model could enhance significantly the command function in the Army of Tomorrow. The model is clearly command-centric and builds on the concept of mission command, effects-based manoeuvre warfare and knowledge-based command. It is meant to work within a staff structure based on the operational function model instead of the continental staff system. Although the complete model is too big to be presented in this paper, it is still interesting to present a level one view of the brigade collaborative commander's battle process to illustrate its connection to ISTAR process (Figure 5).

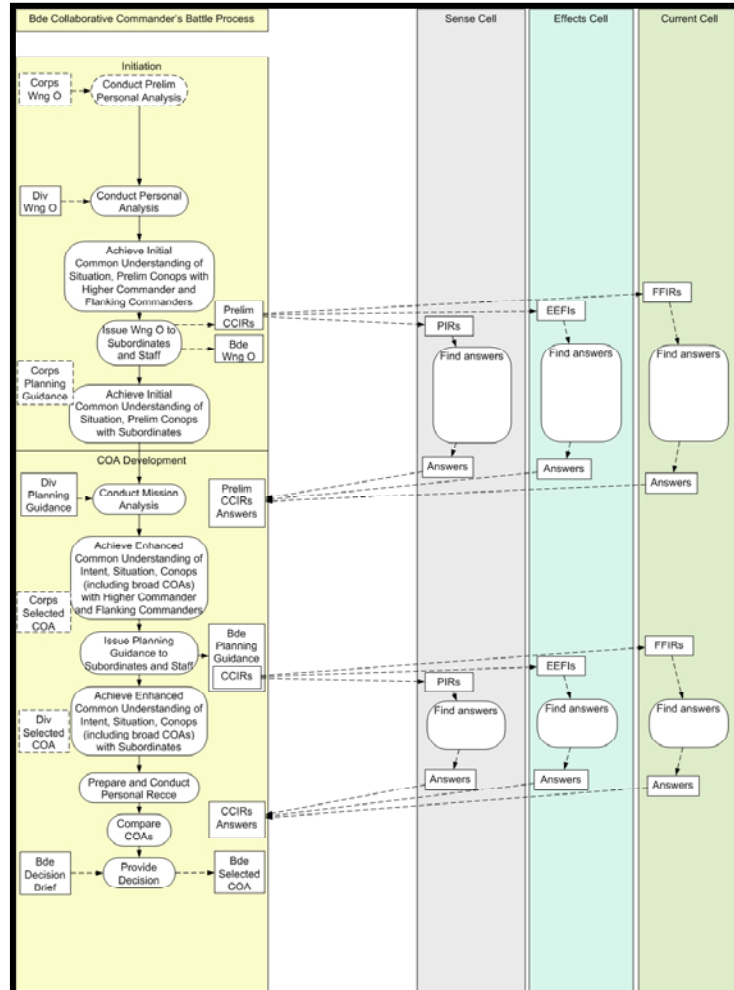


Figure 5: The brigade Collaborative Commander's Battle Process
(Initiation and COA Development steps)

16. The new Collaborative Commander's Battle Process is composed of four phases: Planning Phase (Initiation, COA Development as depicted in Figure 5), Plan Development Phase, Preparation Phase, Execution Phase, and Review Phase. In the Planning Phase, the need is stated for commanders to steer the Knowledge Management process through the definition of Commander's Critical Information Requirements (CCIR) which will be used to orient the actions of the command and sense functions, and to assess the relevance of information provided by the Sense, Effects and Current cells.

17. Since the vision developed for ISTAR required the development of the ISTAR Coordination Function of the Sense cell first, the emphasis was put into the development of the Dynamic Collection Management Service. Through Joint Application Design workshops with user representatives, the Collection Management (CM) process was captured and documented using knowledge management techniques and tools. The captured CM processes are illustrated in Figure 6. The three main processes for CM are: Collection Plan Developed, Collection Plan Executed, and Request for Information Management. These processes have been refined further many levels down and provide a fundamental knowledge element for the development of the proper software units. Again, it was discovered that information technologies when properly introduced in a balanced way (recalling the harmony triangle of Users-Processes-Technology) do not change what the users are trying to accomplish but rather change the way to accomplish it. While procedures tend to structure how you do things in an orderly fashion, we found that, when properly implemented, the system could better support the event driven humane way of doing things which is not always so orderly.

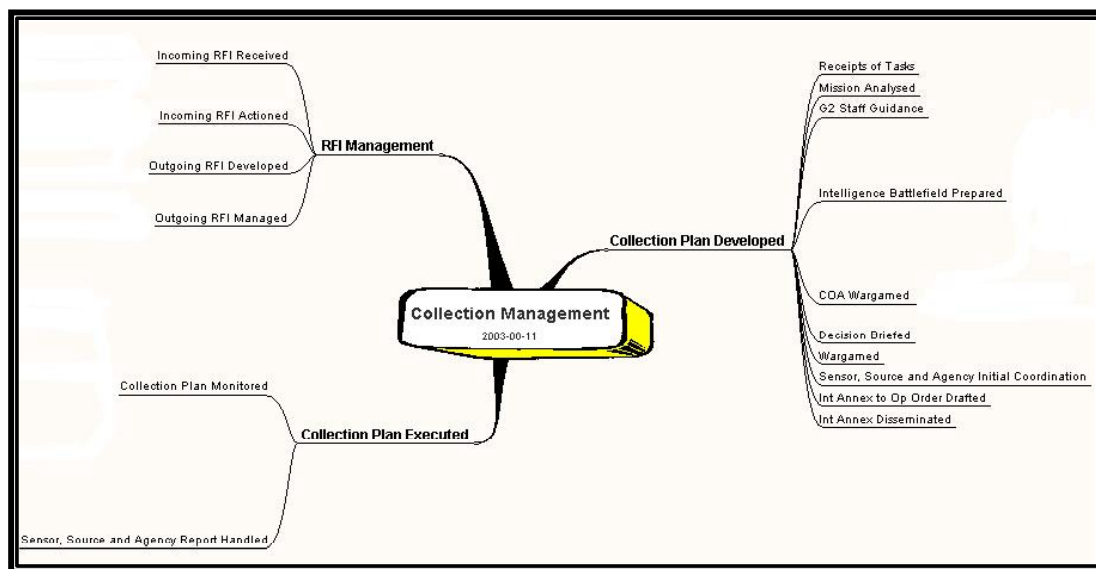


Figure 6 - The Collection Management Processes (Levels 0, 1 and 2)

18. The conditions for transformation in the “processes” perspective imply the reengineering of some information processes if organizations are to really exploit the richness of the information sphere. What was done in the Canadian ISTAR context was to bring the notion of knowledge brokers to manage the balance between information requirements and information collection. Hence, the ISTAR Coordination function of the Sense cell provides information

brokerage services coupled with resource management for information collection. We have seen that in trying to integrate the ISTAR processes into the inherited staff functions we had to revisit completely how the classical continental staff system operated in deployed HQ. When the need to introduce a collaborative working environment was coupled with the recent publication of the new Canadian Land Force Employment concept, we were led to address new fundamental elements: a Concept of Operations for collaborative working, HQ structure re-organization and finally a Collaborative Commander's Battle Process. In summary, while attempting to develop new software supporting the collection management function, we had to revisit all of the apex of the harmony triangle of Figure 1: the Users and its organization, the processes and the technology (systems) in order to find a user acceptable business solution.

Conclusion

19. The transformation brought about by the ICCW concept is now possible because of new modern capabilities associated with information technologies and most notably those associated with information sharing, collaboration, and visualization. We expect this concept will improve our ability to bring all of our information and all of our knowledge and experience to bear. Amongst other things, these modern capabilities enhance the possibility to do collaborative fusion and analysis e.g. parallel information processing that has proven to increase the situation awareness of all connected information workers. It is now understood by the Canadian ISTAR TD team that concurrent information processing such as data and information fusion requires collaborative work under asynchronous information management. Thus, the conditions necessary for success of ISTAR in the Information Age revolve around an organization characterized by asynchronous information flows that are not unduly constrained, where the key parts of individual components can be self-synchronized allowing collaborative fusion and analysis. These are the characteristics associated with true integrated processes. Our objective is to put the Information Centric Collaborative Workspace concept accessible at all levels in the chain of information transformation so that fusion and analysis can be performed whenever and by whoever requires it and that the results become input to the next transformation iterations in the "System of systems". In this way, the whole System design could take into consideration the needs of all users in the information transformation chain. However, before being able to reap the fruits from the information centric collaborative workspace concept, it is also necessary to investigate the other ingredients needed to implement such a concept from the "Systems" perspective.

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Introducing the Canadian ISTAR Information Centric Collaborative Workspace

Paper Two:

From the Processes Perspective

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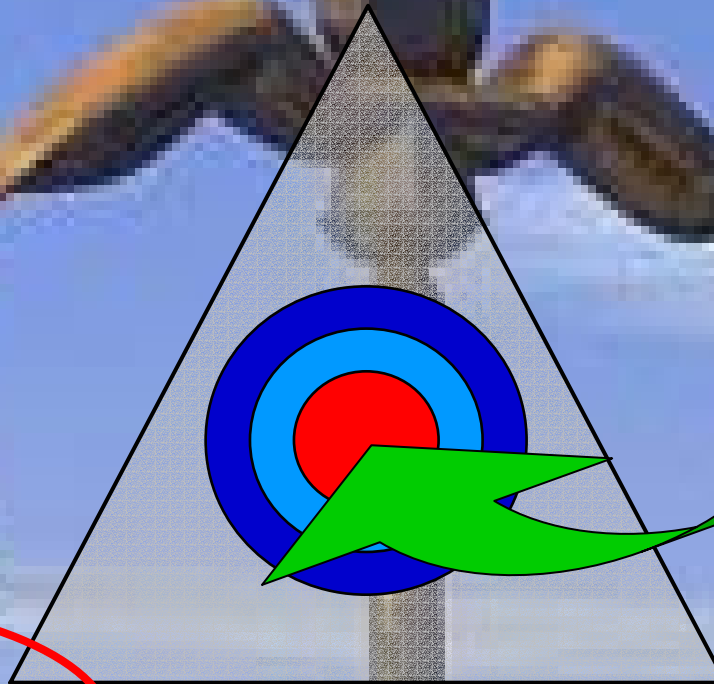


PERSPECTIVE AND BALANCE

System of Systems Harmony Triangle

Users / Organizations

**Business
Solution**



**Processes /
Procedures**

**Systems /
Functionality**



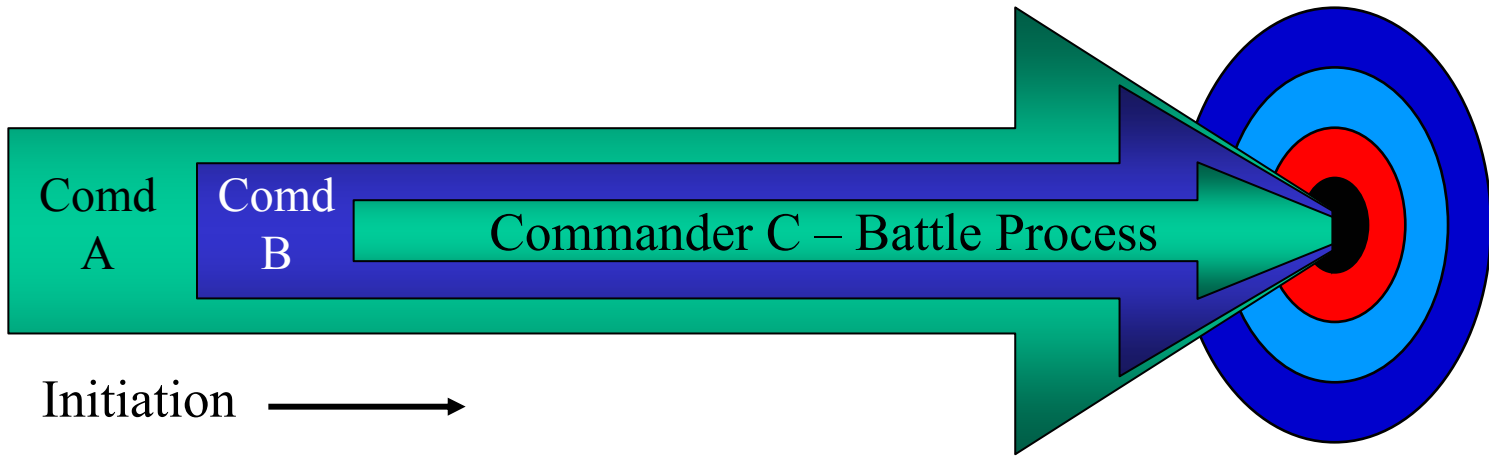
Canadian Forces New Operational Environment

- The Three-Block War context where medium weight forces deployed over complex terrain are against asymmetric threats with an unsympathetic population.
- New Integrating Concepts: EBA (the “what”) and NEOps (the “how”).
- Continental Staff System lead to stovepipe systems not conducive to collaborative working.
- Need to revisit the commander’s battle process.





Synchronizing and Overlapping Commanders Battle Processes

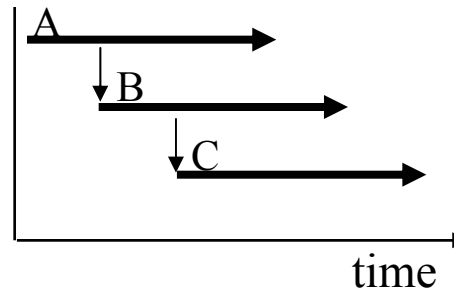
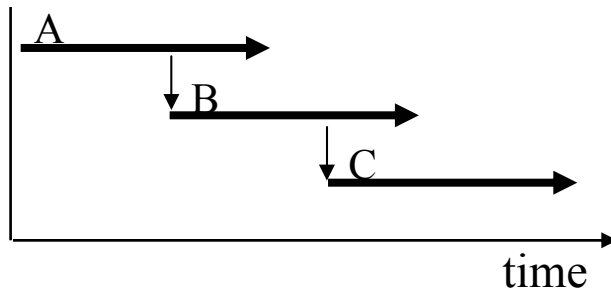


Initiation →

Planning →

Execution →

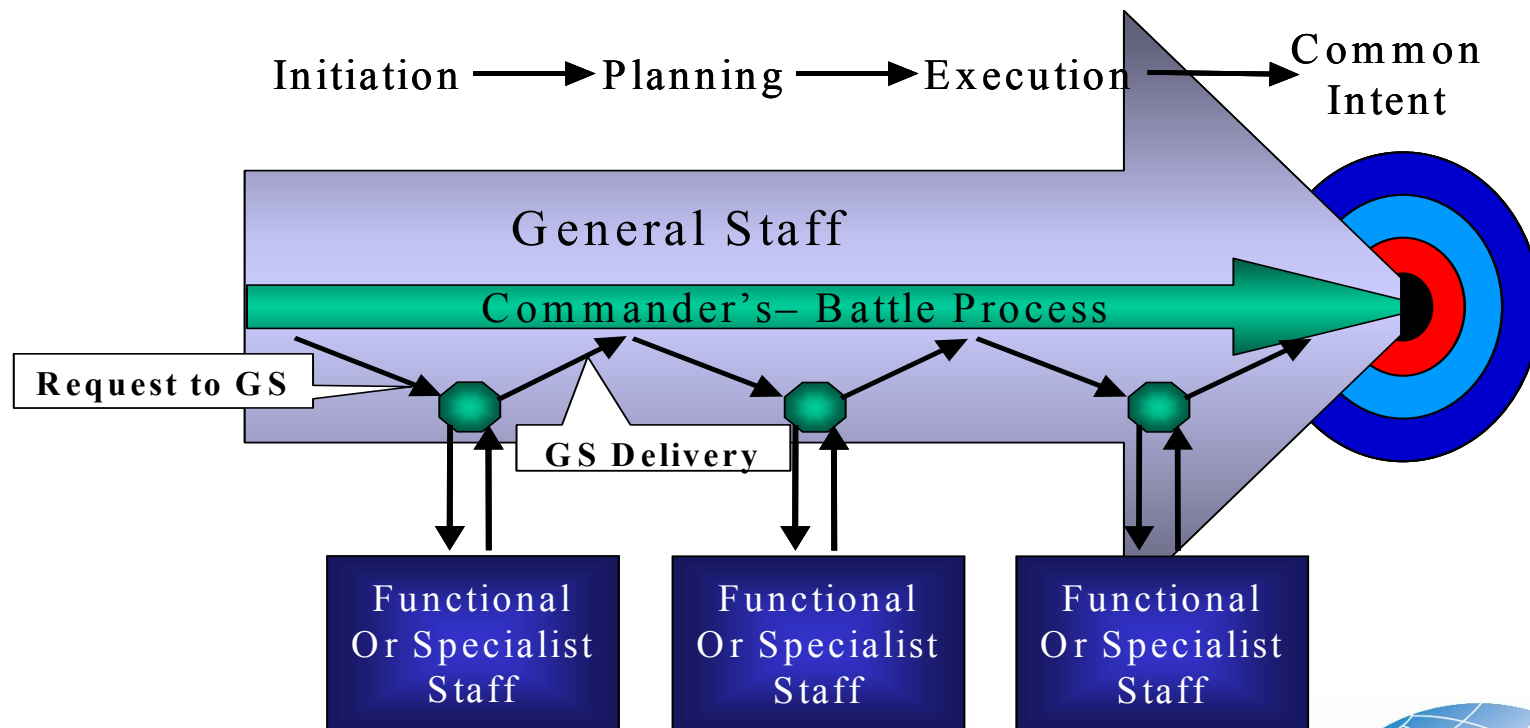
Common
Intent





The Collaborative Command Centric Concept

- **Collaborative Working Concept:** “The environment in which a military commander makes the best use of available knowledge, experience and intellect from command and staff teams to achieve a common purpose.” (CA CW CONOPS 2004)





Promoting a Collaborative Culture

- Mutual trust and respect
- Power based on expertise and accountability
- Respect for diverse perspectives
- Shared leadership where all team members are expected to take the initiative
- Valuing truth telling
- Commitment to the organizational goals
- Active learning





Preservation of Operational Tempo

- The Three-Block War operational tempo requires:
 - Clear and consistent understanding of commander's intent;
 - High quality information and shared situational awareness;
 - Competence at all levels of the force; and
 - Trust in the information, subordinates, superiors, peers and equipment.
- Self-Synchronization rests upon the Human Dimension.





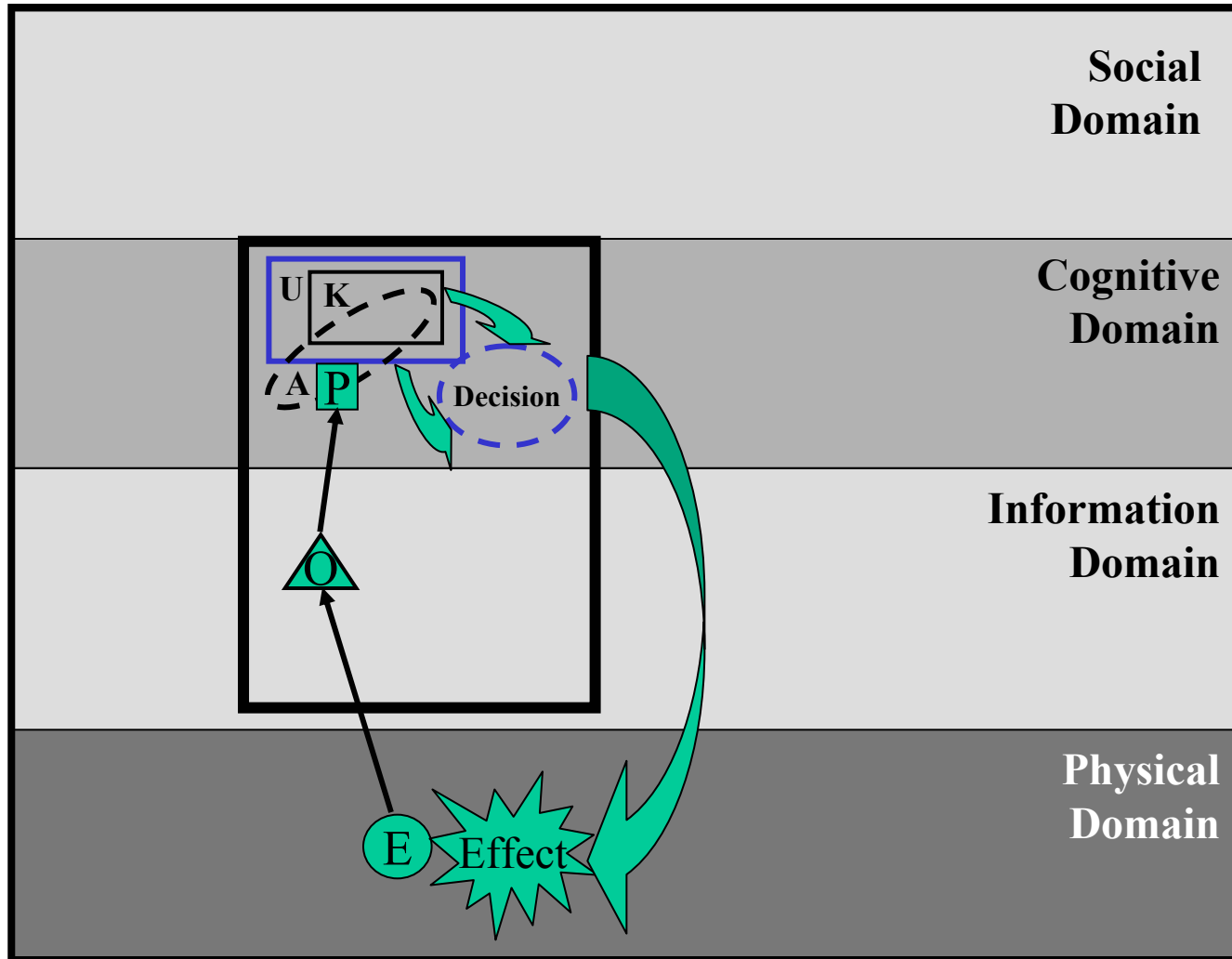
Research Questions

- What is collaboration and how to best encourage a collaborative culture?
- How to achieve shared sense-making?
- What are the processes that enable to go from shared awareness to shared understanding to collaborative decision-making?
 - Clearly a socio-cognitive activity because the individual's cognitive activities are directly impacted by the social nature of the exchange.
- What are the tools, methods, technologies nurturing a collaborative culture?





Individual Action



A: Awareness

O: Observation

P: Perception

E: Event

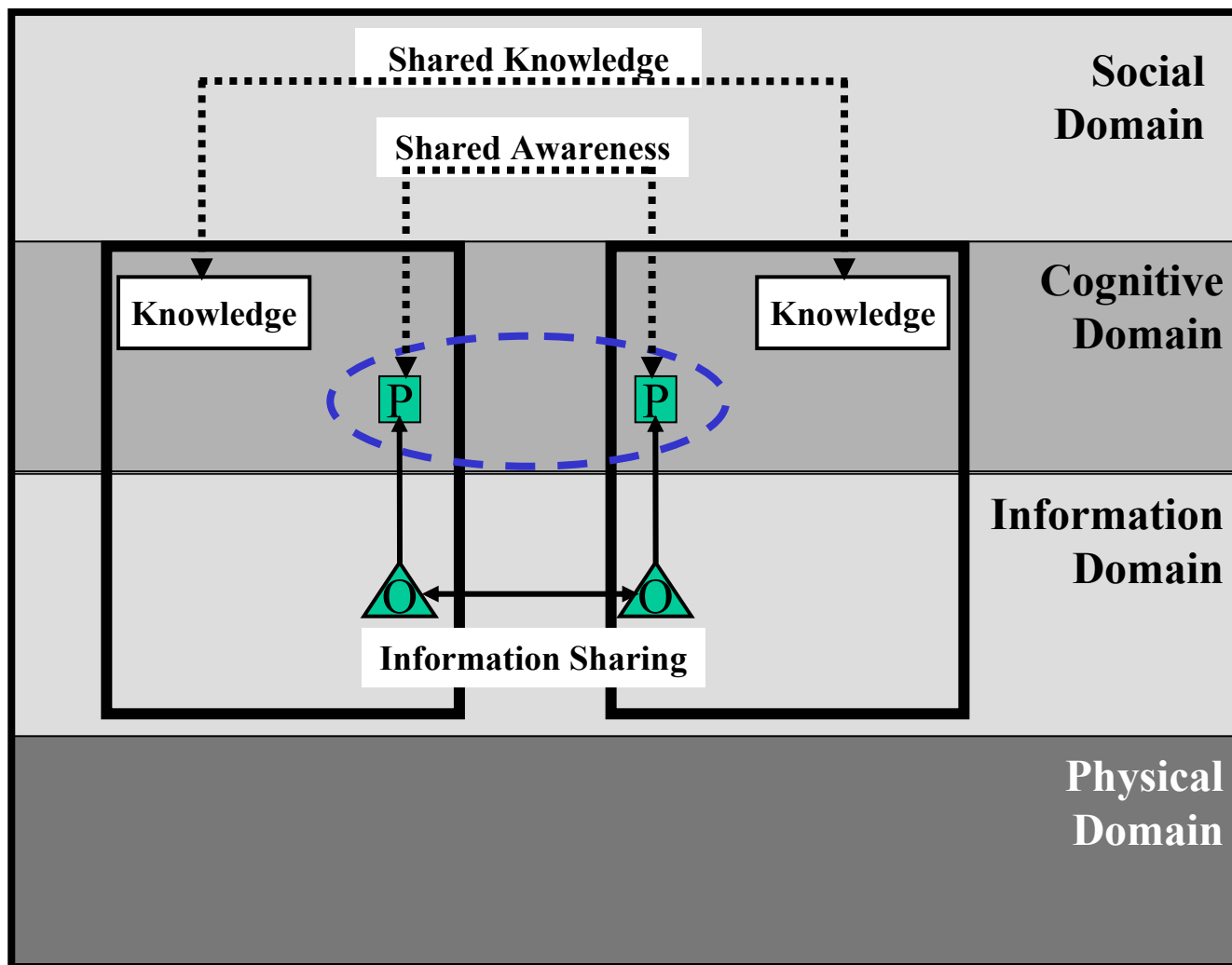
K: Knowledge

U: Understanding





Shared Awareness / Knowledge



A: Awareness

O: Observation

P: Perception

E: Event

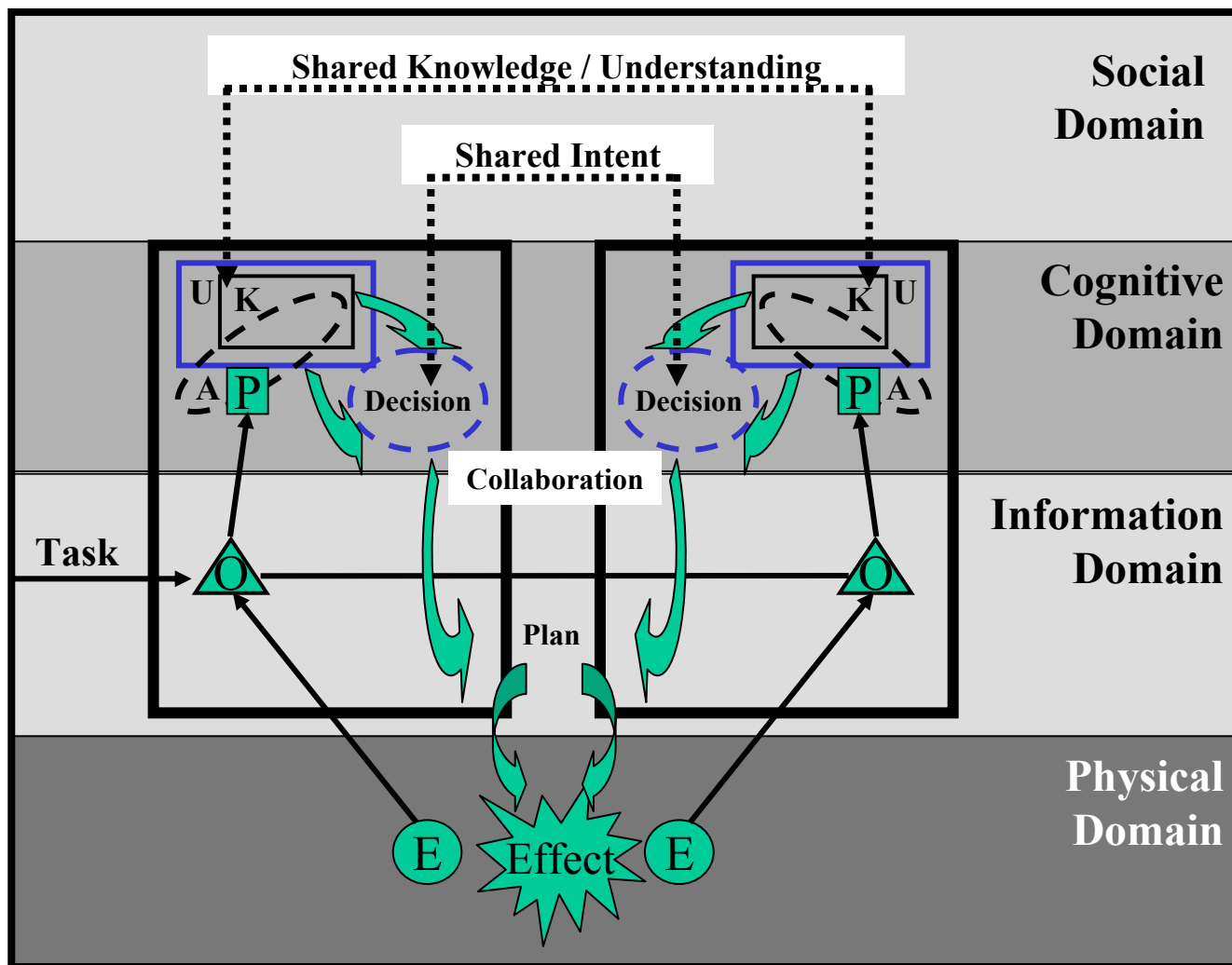
K: Knowledge

U: Understanding





Collaboration → Synchronization



A: Awareness

O: Observation

P: Perception

E: Event

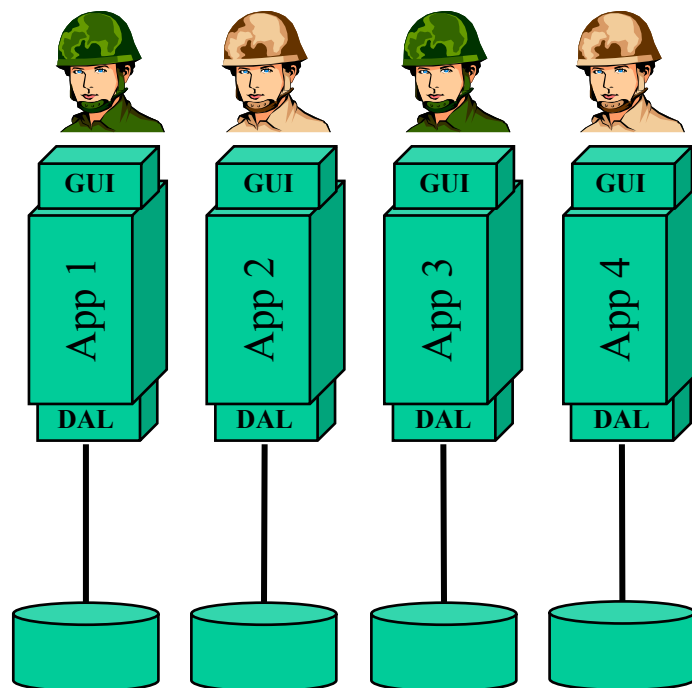
K: Knowledge

U: Understanding





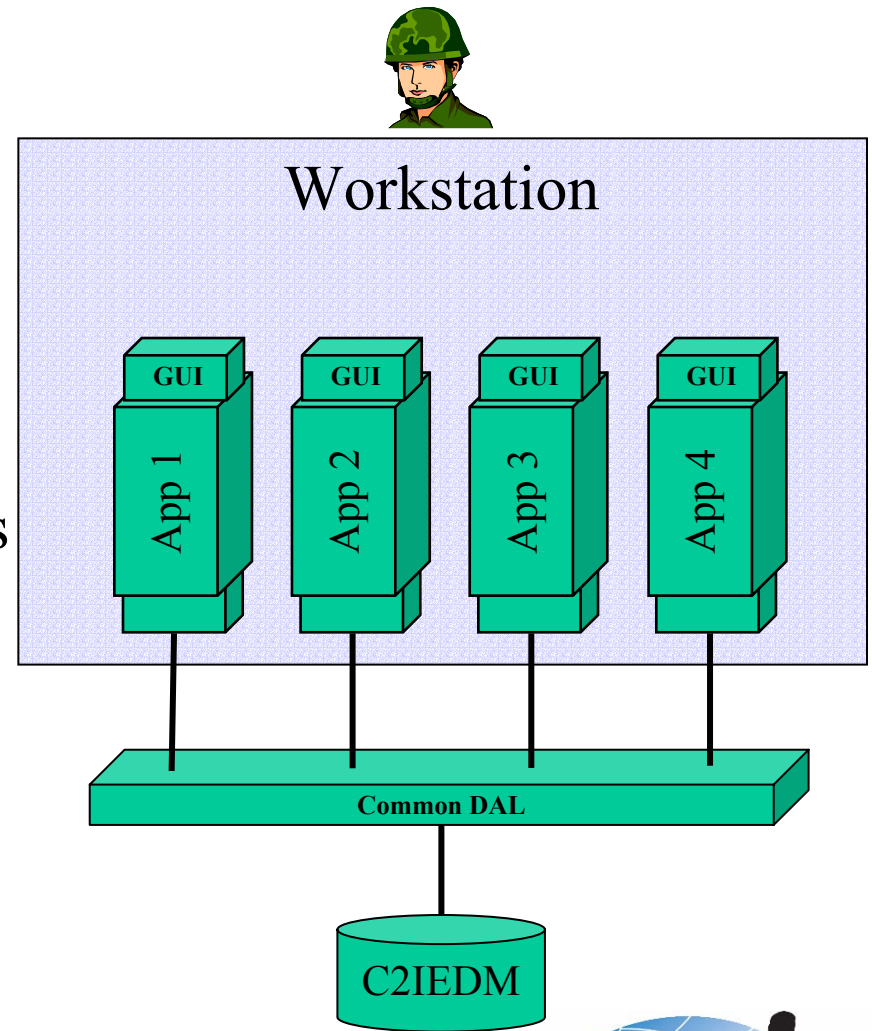
Stovepipe Systems





Data Centric Workspace

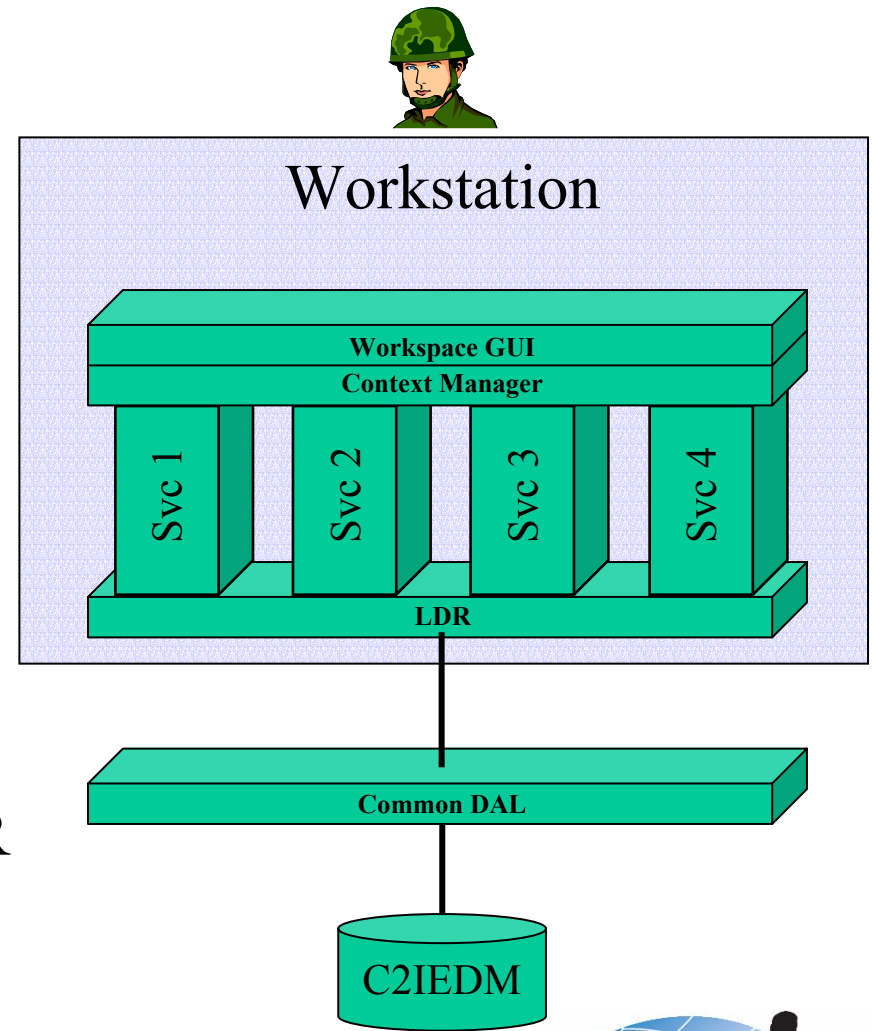
- **Data Centric Workspace:**
Technological capability to have several applications accessing heterogeneous data bases using the same semantic. (CA ISTAR TD 2002)





Information Centric Workspace

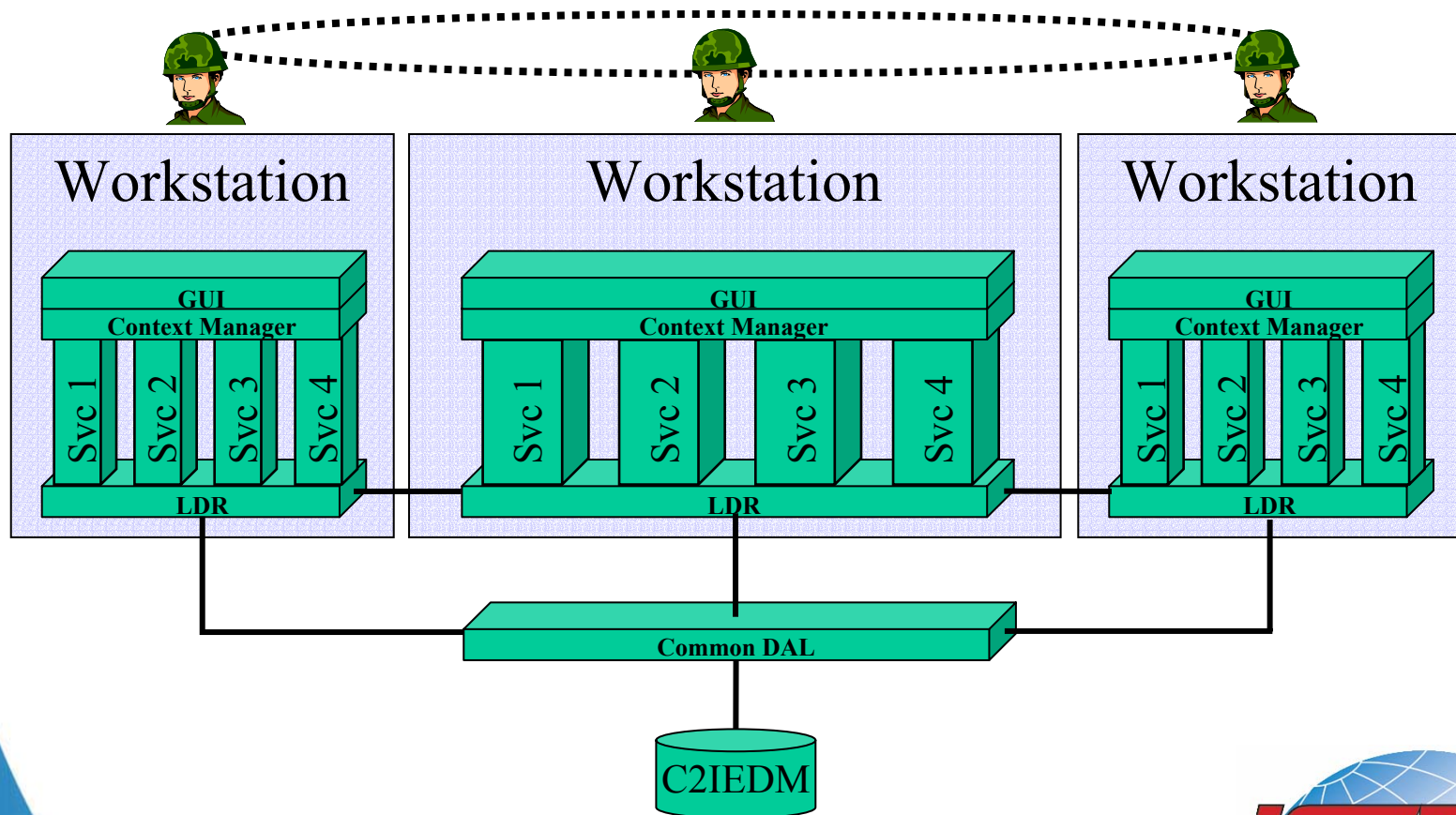
- **Information Centric Workspace (ICW):** Technological capability to have several complementary applications developed on common standards and sharing the same contextual data and information on a workstation. (CA ISTAR TD 2003)





Information Centric Collaborative Workspace (Same Node)

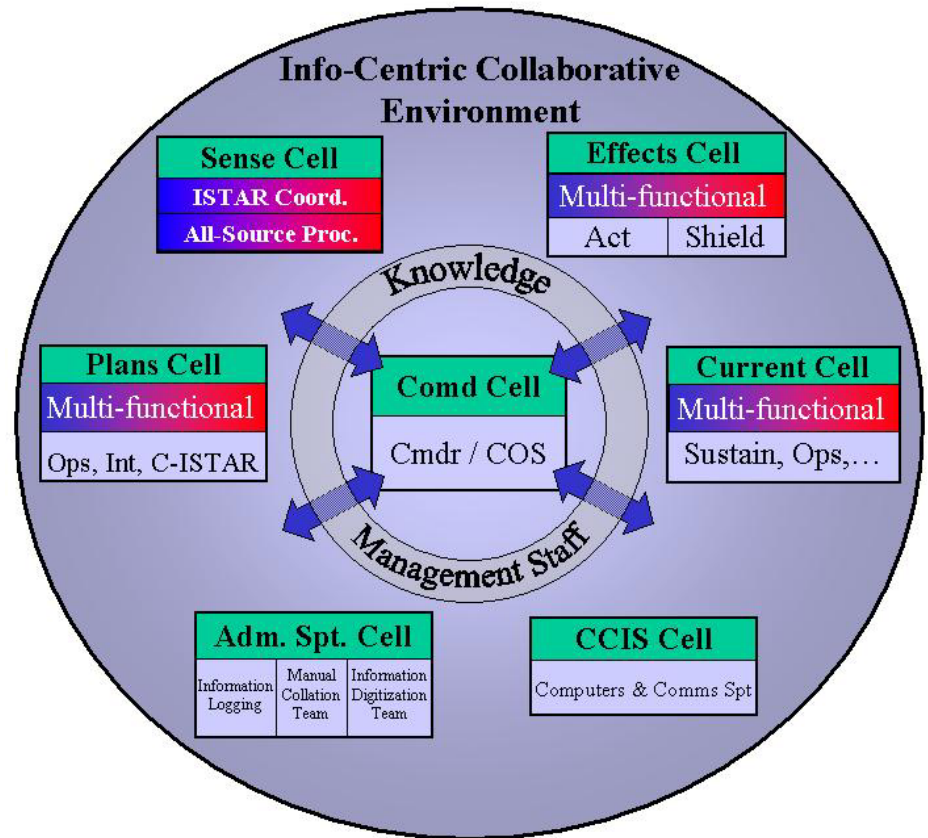
- An environment facilitating the cognitive and social processes through a System of systems services architecture (ICW). (CA ISTAR TD 2004)





Collaborative Command-Centric Concept

- Need to network all actors enabling them to access heterogeneous information using same semantic
- Need to have common standards for sharing the same contextual data and information on a workstation
- Encourage using same tool box approach
- Need to develop and nurture collaborative work processes
- Need to establish MOE and MOP to measure collaborative working benefits





Conclusions

- The role of the human in the network is essential, and thus human factors play a significant role in how information is accessed, displayed and shared.
- The development of intuitive interfaces is critical to shared awareness especially across different organizations and coalition partners.
- Technical interoperability will get us to the point where the information is correctly represented in distributed systems, but does not ensure that the individuals in different locations, in different organizations, at different echelons have a similar understanding even though they “see” the same thing.
- Information-Centric Collaborative Workspace is a concept that should support greater collaborative working leading to a better synchronization





Questions?



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